

Polistes major (Hymenoptera: Vespidae) Predation of the Treehopper, *Umbonia crassicornis* (Homoptera: Membracidae)

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Abstract.—*Polistes major* Palisot de Beauvois hunted for the treehopper, *Umbonia crassicornis* Amyot and Serville, by randomly contacting with their mandibles any object that protruded beyond the branch surface until they found a treehopper. They then altered their behavior and repeatedly attacked the prey. When female treehoppers were attacked, they usually sat quietly throughout the attack and none were captured. When nymphs were attacked, they moved away from the wasp while the parent female actively repulsed the paper wasp.

Umbonia crassicornis Amyot and Serville is a membracid that is an occasional pest of leguminous trees and shrubs in southern Florida (Butcher, 1953; Mead, 1962). A female will oviposit in host plant tissue which can be encircled with the metathoracic legs (Dowell and Wood, pers. comm.). She will guard her eggs until just before eclosion at which time the parent female will make a series of feeding slits in the host plant tissue below the egg mass. The female actively maintains the nymphs in an aggregation and defends them against predators. Eggs or small nymphs without an attendant female have low survival rates (Wood, 1974, 1976).

Predation is considered a major factor influencing the evolution of presocial behavior in membracids (Wood, 1974) and a number of predators have been observed feeding on *U. crassicornis*, including spiders, assassin bugs, coccinellids, lygaeids, anthocorids, and pentatomids (Wood, 1976). Beyond this, little is known of the predator-prey relationship for *U. crassicornis*. We describe the predatory behavior of *Polistes major* Palisot de Beauvois on *U. crassicornis*, and the responses of the prey.

METHODS

We observed individual paper wasps hunting on powder puff plants (*Calliandra* sp.) at two sites at Fort Lauderdale, Broward County, Florida in May and June 1978, 1979, and 1980. Three to 7 days were spent each year observing the behavior of the wasps and membracids. A wasp ($n = 60$) was observed as it flew near the powder puff plants and was followed until it left the area. We noted the behavior of the wasp, the number of times it contacted individual branches, whether *U. crassicornis* was present and its instar, whether the wasp successfully captured prey and the instar captured, and the responses of the *U. crassicornis* nymphs and adult females to the wasp attack.

RESULTS

A paper wasp would fly to the powder puff plant and began to fly slowly in an up and down pattern within 1–2 cm of the outer branches. The wasp made contact with any object protruding from the underside of the branch surface. Contact was made with the mandibles, as in other *Polistes* spp. (Rabb and Lawson, 1957). Leaf bracts were encountered more frequently ($n = 421$) than *U. crassicornis* ($n = 291$). Each wasp made contact with an average of 12.5 ± 3 ($\bar{x} \pm S$) branches per minute. A wasp seldom made more than one contact with a branch lacking prey (1.1 ± 0.05 , $n = 392$ branches). The paper wasp continued this search pattern until it contacted an *U. crassicornis* nymph or adult. The wasp then began to fly rapidly in an up and down pattern in a series of attempts to seize the treehopper with its mandibles. A wasp made significantly more contacts with branches having *U. crassicornis* (4.9 ± 4.8 , $n = 59$ branches) than without. When a parental female was the intended prey, the attacks were directed accurately toward her. In contrast, the wasp attacked any nymph within 4 cm of the initial contact point.

Twenty-one parental females guarding eggs were attacked, but none were captured. When attacked, a female on eggs either sat motionless on the branch or fanned her wings and tilted forward. The adult treehopper appeared to be too large for *P. major* to seize in its mandibles although we observed several *Sphecius speciosus* (Drury), a larger wasp that preys on cicadas, capturing *U. crassicornis* adults in 1980.

When nymphs were attacked, they moved away from the wasp. The parent female quickly responded to the nymphs' alarm pheromone (Wood, 1976) by moving toward the wasp while fanning her wings, twisting and tilting forward. She attempted to physically intervene and drive the wasp away. The wasp generally redirected its attack toward the parent female. This behavior was effective in repulsing 81% of the attacks by individual paper wasps.

The paper wasp continued its attacks against the nymphs until driven off by the parent female or until it captured a nymph. A wasp made more contacts with an aggregation from which it captured a nymph (7.6 ± 5.4 contacts, $n = 11$ aggregations) than with those where they were unsuccessful (4.3 ± 4.5 , $n = 48$). An unsuccessful paper wasp continued hunting. A successful wasp flew to a nearby branch and chewed the nymph into a ball before leaving the area. Variation in the color pattern of the paper wasps allowed us to ascertain that individual wasps were returning to the powder puff trees over several successive days.

When the parental female was absent, the wasps were successful in capturing nymphs 90% of the time. The low number of aggregations without a female ($n = 2$) precludes statistical analysis.

Nymphs captured were 1st (9%), 2nd (28%) and 3rd (63%) instars. We observed no nymphs larger than 3rd instar being captured despite attempts by 17 wasps.

The defensive behaviors exhibited by *U. crassicornis* to the paper wasps are the same as those observed against other predators (Wood, 1976) and are similar to those observed in other treehoppers (Hinton, 1977). In 1978 and 1979, the wasps ceased hunting for *U. crassicornis* after 1–2 weeks, despite the continued presence of nymphs. Only 1–2 wasps were observed searching each tree. In 1980, the wasps discontinued hunting on powder puff plants only after virtually all nymphs were gone, a behavior more typical of *Polistes* spp. (Kasuya, 1980; Rabb

and Lawson, 1957; Yamasaki et al., 1978). In 1980 7–10 wasps were observed per tree.

Although *P. major* is a predator of *U. crassicornis*, it is difficult to estimate the effect it has on treehopper numbers. Treehopper females can effectively repulse the wasps from their progeny. However, large numbers of persistent paper wasps can eventually capture most nymphs as they did in 1980.

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